The Taxonomy of the Extant Solenodontidae (Mammalia: Insectivora): A Synthesis*

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With 6 figures

Introduction

After the discovering of the Cuban and the Hispaniolan Solenodons in the last century, it was generally agreed that they belong to the same genus. Only in 1925, the Spanish zoologist Cabrera gave both forms generic status. Certainly, Angel Cabrera was one of the outstanding mammalogists of the first half of this century. However, it also can be said that he was a typical representative of that time. To wit, he was a great "splitter" (see Simpson, 1945), a taxonomist who attached to small differences great systematic and nomenclatorial importance, largely neglecting or not being aware of the variability limits of the characters treated. The group of mammal taxonomists to which Cabrera belonged had, however, extensive experience in practical taxonomy and therefore quite often came to tenable conclusions. But sometimes it went wrong as will be shown in the following study.

Modern taxonomy embraces a great spectrum of animal research fields, including also many non-morphological themes, as was pointed out by SIMPSON (1945). This enables the prospect of future revisions with the advances of any special branch of science contributing to taxonomy. Additionally, in the sense of MAYR (1975), the most important taxonomic contribution of a specialist having collected and studied more material than a previous worker, is a revision. This is the nature of this paper.

Nomenclatorial history

The first reference of a West Indian mammal possibly identical with the recent Solenodon could have been the one by OVIEDO (1535), who, however, named it "Aire" after a certain shivering movement of the animal's head, resembling the behaviour of a drunkard (zorá = aire = drunken. See Peters, 1863). In 1833, the genus Solenodon was firstly described by Brandt after a mounted Hispaniolan specimen with an incomplete skull. The Cuban form was first mentioned in 1834 by Poey in

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the periodical "El Plantel" and described scientifically by the same author 17 years later (Poey, 1851). Poey thought it to be conspecific with the Hispaniolan Solenodon paradoxus Brandt, 1833, and described is as Solenodon paradoxus too. 10 years later, in a short note (Anonymus, 1861), the name of a Solenodon, Peters had reported about in a session of the Berlin Academy of Sciences in 1861, was indicated with "Solenodon cubanus (S. paradoxus Poey, non Brandt)" Only two years later Peters' publication about the specimen, caught by Gundlach in Cuba, brought Peters' description (1863), but also the surprising and uncorrect statement that Poey in his paper (1851) had dealt with the genus Solenodon only. Therefore, the complete name of the species correctly should read ,, Solenodon cubanus Peters, 1863 (= S. paradoxus Poey, 1851, non Brandt, 1833)"

GUNDLACH (1877) considered S. cubanus and S. paradoxus as two species, whereas Dobson (1882) thought them to be local forms of one species. Allen (1908) was inclined to concede them subgeneric status, without, however, expressing himself definetely. Finally Cabrera (1925) put the Cuban form in its own genus, Atopogale cubanus.

This was not recognized generally: after Cabrera's publication many authors kept considering the two taxa as two species of a single genus (Weber, 1928; Bridges, 1936; Mohr, 1937; Wislocki, 1940; Allen, 1942; Barbour, 1944; Simpson, 1945; Angulo, 1947; Crandall, 1949, 1964; Eisenberg & Gould, 1966; Tijskens, 1967; Cave, 1968; Alcober, 1972; Varona, 1977, 1983; Starck, 1978; Morgan et al., 1980; Eisenberg, 1981). McDowell (1958) and Honacki et al. (1982) do not enter the discussion and remain indifferent. Only Hall & Kelson (1959), Herter (1968), Kratochvil (1976), and Hall (1981) followed Cabrera in every respect by retaining his criteria of distinction.

Material and method

Alltogether, 87 museum specimens and 11 alive Solenodons were studied, measured and photographed. The comparison of the individual measurements and its remarkable and unexpected irregularities will be subject of a forthcoming publication.

Alive specimens of Solenodon paradoxus were studied in the following institutions:

2 in Frankfurt Zoo (1; 1), 1971-1973,

1 in Washington Zoo (1; 0), at several visits there,

4 in Santo Domingo Zoo (2; 2), February to April 1976, June 1978, February 1982,

4 in our Insectivore Research Center, Wien (2; 2), November 1978 to date.

The skeletal material of 71 Solenodon paradoxus was studied in the following collections:

Museum of Comparative Zoology, Harvard, Cambridge (MCZ)	23
National Museum of Natural History, Washington (NMNH)	6
American Museum of Natural History, New York (AMNH)	6
Carnegie Museum of Natural History, Pittsburgh (CMNH)	1
Field Museum of Natural History, Chicago (FMNH)	4
Zoologisches Museum der Universität Hamburg (ZMUH)	8
Instituut voor taxonomische Zoölogie, Amsterdam (ZMA)	2
Senckenberg Museum, Frankfurt (SMF)	2
Naturhistoriska Riksmuseet, Stockholm (NRS)	1
Naturhistorisches Museum, Wien (NHMW)	2
Muséum National d'Histoire Naturelle, Paris (MNHN)	6
British Museum (Natural History), London (BMNH)	6
Collection Poduschka, Wien (P)	4

Additionally, several skins and mounted specimens of *S. paradoxus* which might belong to the above mentioned skeletal material, were examined in these institutions.

The skeletal material of 16 Solenodon cubanus were studied in the following collections:

MCZ, Harvard	4
NMNH, Washington	7
FMNH, Chicago	2
BMNH, London	1
University Museum, Cambridge, UK	1
MNHN, Paris	1

Furthermore, 4 mounted skins of *S. cubanus*, in Chicago, London, Washington, and New York, were studied. It is, however, not clear, if they belong to one of the just enumerated skeletons.

CABRERA's establishing of two genera apparently never has been criticized or challenged, but mostly either neglected or not mentioned. In this paper, his criteria are revised as also compared and evaluated from examination of the above-named material. Additional criteria, as indicated by Peters (1863), Dobson (1882), Leche (1907), and Allen (1910), but not used by Cabrera as characters ("caracteres" = characteristics), were similarily utilized.

Confrontation of the criteria and discussion

CABRERA (1925) considered the osteological and dental differences of the two taxa sufficient to asign each generic status. However, he never mentioned the number of specimens studied or compared, or whether he relied only on previous descriptions, drawings or photographs. Considering his statements about the animals' nutrition, he obviously had no experience with living specimens of either taxon and apparently relied heavily on earlier authors. This is even shown in an error in his key of the family Solenodontidae. There CABRERA maintains that the urogenital opening and the anus are separated ("Los órganos genitales externos se

hallan bien separados del ano"). This, however, is the case only in the male, whereas the female has urogential and anal openings united in a well-developed pseudocloaca formed by skin folds around both body openings. Thus, in this respect only the female *Solenodon* shows a similar arrangement like the Tenrecidae, where both sexes have a similar pseudocloaca. Obviously, he follows Dobson (1882), who, however, besides two skulls described only the body of one male specimen (in alcohol).

PETERS' criteria (1863), most of them also adopted by Dobson (1882):

The skull of S. cubanus is broader, the fur on the back is 75 mm in length in S. cubanus, whereas in S. paradoxus it is maximally 35 mm, the incisive foramina of S. cubanus are smaller. The extremity of the zygomatic process of the maxillary is as high as its root in S. cubanus, whereas in s. paradoxus it is half as tall and forms a small, bent arch.

The space over the lachrymal foramen is deeply grooved and sharply defined posteriorly as well as above and below, while in *S. paradoxus* it is shallowly concave and without distinct limit.

There is a greater width and depth of the mesopterygoid fossa in S. cubanus, similarly, a longer mental symphysis and a much more acute angle is formed between the mandibles at their point of union.

In dentition S. cubanus differs from S. paradoxus in the comparatively smaller size of the molars and in the greater length of the row formed by the incisors, canines, and premolars. The first upper incisor of S. cubanus is also smaller, more slender, and more acutley pointed; the second and third incisors have no anterior basal cusp; the canine and the first premolar are much larger than in S. paradoxus, and have no basal processes. The molar have a much less-developed cingulum in S. cubanus. Corresponding differences are found in the lower teeth.

Remarks on Peters' and Dobson's criteria:

Peters (1863) compared the holotype of Solenodon paradoxus (3) with a Cuban specimen (2) caught by Gundlach. Both animals retained maxillo-praemaxillaris sutures and were, therefore, not full-grown; their relative age, however, can be different. It also has to be emphasized: mature Insectivora are not necessarily full-grown. Peters' descriptions of the zygomatic processes of the two forms are unclear to me, unfortunately.

The greater length of the tooth row (minus the molars) and the smallness of the molars is no criterion, since not even all full grown specimens have teeth of equal size.

Dobson (1882) obviously repeated Peters' words by describing – when studying the Cuban form – an adult male in the Paris Museum, and a skeleton of another quite full grown specimen from the Hunterian Museum. Unfortunately, he does not specify the number of Solenodon paradoxus individuals at his disposition.

Leche (1907) considers the differences in the dentitions of the two forms insignificant ("geringfügig"). Considering the facts that the I² of S. paradoxus has both anterior and posterior basal cusps, whereas S. cubanus only has a posterior one; that the canine (Leche does not precisize if upper or lower) of S. paradoxus has a distinct basal cusp, whereas

S. cubanus lacks it; that P⁴ of S. paradoxus has an anterior basal cusp absent in S. cubanus, Leche is inclined to conclude that the dentition of S. cubanus is somewhat more differentiated than in S. paradoxus. Leche, when writing about Solenodon (obviously S. paradoxus) mentions that the Os proboscis is present ("Rüsselknochen vorhanden").

ALLEN (1910) adds the following differential criteria: The tail of Solenodon paradoxus is long and stout, though rather more slender, relatively, than in S. cubanus. Regarding to the interpretygoid fossa, ALLEN follows Peters and indicates that the diastema between I³ and C is about 2 mm in S. cubanus. He also mentions different occlusal outlines of the P². According to Allen, S. paradoxus has a separate Os radiale and intermedium, which, according to Dobson are fused in S. cubanus. Furthermore, Allen counts the following numbers of the vertebrae:

S. paradoxus: 7 cervicals, 16 dorsals, 4 lumbars, 4 sacrals, 24 caudals = 55
S. cubanus: 7 cervicals, 15 dorsals, 4 lumbars, 5? sacrals, 23? caudals = 54?

ALLEN assumes that the fifth sacral vertebra of S. cubanus seems to belong to the caudal group of vertebrae. Lastly, S. cubanus has a sternum consisting of 7 elements, whereas S. paradoxus has but 6. He writes "This difference seems clearly to be due to the complete fusion in S. paradoxus of what in S. cubanus are the fifth and sixth pieces, so that in the former the penultimate element of the sternum gives attachement to three sets of ribs instead of but two as in the latter. The absolute length of the articulating segments of the sternum is thus some 6 mm shorter in S. paradoxus than in the Cuban species, nothwithstanding the greater general size of the former. A second difference is found in the shape of the xiphioid process which in S. paradoxus is simple, whereas in S. cubanus it is represented as of two lateral portions fused anteriorly" Allen maintains also that S. pradoxus has 8 palatine rugae, whereas according to Peters (1863), S. cubanus has 9.

Remarks on G. M. Allen's criteria:

Minor differences in length and form of the tail are individual features. The separation or fusion of radiale and intermedium is a matter of age. The mentioned number of sternal elements is also an individual feature.

Palatine rugae obviously were counted on drawings of the respective species. However, counting them in preserved specimens is very often submitted to personal errors or individual opinions about what to count as a fold and what to omit. Eisentraut (1976) comments on these difficulties, as also on a certain variability concerning interruption or even lack of a fold, which occurs in rodents, primates and some Megachiroptera (Van Bree, pers. comm.).

The previously cited authors (Peters, Dobson, Leche, Allen) mentioned several more criteria than those considered by Cabrera, who, however, was aware that in unspecialized mammals numerous individual variations must be anticipated.

CABRERA's criteria

Genus Solenodon

- A. Fur coarse of medium length.
- B. Anterior claws as long as the toes.
- C. Prenasal bone, placed horizontally in front of premaxilla.

Genus Atopogale

Longer and finer fur.

Claws more delicate but considerably longer than the toes.

No prenasal bone.

- D. Roundish mesopterygoid fossa wider anteriorly than posteriorly.
- E. Tympanic rings more separated posteriorly than anteriorly.
- F. -NA (not applicable).
- G. I3 in contact with canine.
- H. C with small anterior cusp formed by cingulum.
- J. P³ (or second existing premolar) simple, conical with oval base.
- K. 16 dorsal vertebrae.

Mesopterygoid fossa a bit narrower anteriorly than posteriorly; by that gradually extending the pterygoids, ending in a large hooklike apophysis.

Tympanic rings separated more widely anteriorly than posteriorly. The teeth are generally smaller than in *Solenodon paradoxus*.

I³ separated from canine by short diastema.

Canine lacks small anterior cusp. P³ is relatively large and has a posterorinternal prolongation, giving its base a triangular outline.

Only 15 dorsal vertebrae.

Comments and evaluation of the criteria cited by CABRERA

Very few specimens or parts of both forms were investigated by the cited authors relative to the number of individuals, we were able to study. CABRERA's remarks that some other mammals had been put into different genera on account of at least as distinct osteological and dental differences has to be rejected. The greater part of the examples cited by him today are considered either as doubtful subgenera (Mus and Leggada) or as junior synonym; Rheinthronycteris (Chiroptera: Phyllostomidae), now considered as a junior synonym of Phylonicteris; or Crossogale, being a junior synonym of Chimmarogale.

The following remarks refer to the tabular criteria:

A. It is correct that the fur of *S. cubanus* is longer. We doubt if it is finer too. After we could not feel a difference in flexibility and/or brittleness, microscopic investigation did not yield a marked structural difference. Also, since every hair has differing diameters, the comparing of the hairs of both taxa would depend on subjective selection of the spot to be measured on each hair. Even when neglecting the possibility of individual differences (see Barbour, 1944, who tried to create additional subspecies in *Solenodon cubanus* based on color differences only), such differences might be caused by different habitat and climate. According to the experiences of Eisenberg and Gonzales (1983) and the indications by Varona (1983), *Solenodon cubanus* lives in high altitudes (at least above 630 m) and probably spends considerable time foraging beneath the surface

composed of a thick layer of soft plant litter. Longer fur on individuals living in higher altitudes is known among several mammalian species*. Thus, hair length and color, which latter may be caused by different heavy metal content of the substrate (PODUSCHKA and NOPP, 1978) do not justify setting up a separate genus for Solenodon cubanus.

- B. Claw length depends upon the age of the specimen and the use of its claws. Younger specimens of S. paradoxus have much shorter claws than older ones. Furthermore, when living on soft soil (see Eisenberg & Gonzales, 1983), the claws grow much longer than on a rather hard laterite or coral lime substrate characteristic of the greater part of the habitat of Solenodon paradoxus on Hispaniola. Occurrence of extremely long and obviously unused claws as shown in Fig. 1 and reported as typical of S. cubanus is a gerneralization which seems to have been too eagerly copied: Mohr (1938) published photographs of Cuban Solenodons with claws no longer than average for S. paradoxus. Fig. 2 shows the claws of a Solenodon paradoxus with claws longer than the toes which, after Cabrera, is a differentiating criterion between the two forms.
 - Therefore, claw length seems a trivial, transistory condition which does not permit intergeneric distinction.
- C. Cabrera made here a mistake: Solenodon has no "hueso prenasal" (= prenasal bone), as in Xenarthra, especially Bradypodidae. Solenodon has an os proboscis (= os nasi), which can be found in those mammals which use their proboscis intensively. The os proboscis is an ossification derived from the cartilagous septum or another cartilage and develops only with advancing age. In addition to Solenodon, the os nasi can be found in Rhynchocyon, Nasua, Tapirus, Sus, Saiga, Talpa, et al. (Starck, 1979). Indications of such ossifications might even be found in such shortlived mammals as shrews (Dulić, pers. comm.).

Admittedly, the os proboscis has not been found in the very few S. cubanus investigated. Thus they may all have been young animals. The radiogram of a Solenodon cubanus without an os proboscis (EISENBERG & GONZALES, 1983) is no proof of identidy, since the age of the specimen is not known. The female Solenodon (and BRANDT's holotype of Solenodon paradoxus) investigated by Peters (1863) — whose publication seems to have served as a major source for later authors — were not old specimens. Peters expressly mentions the maxillo-premaxillary suture seen in both specimens. This suture fuses completely in full-grown specimens only.

D. This must be considered as a trifling quantitative feature: Width and form of the mesopterygoid fossa vary considerably.

It may be pointed out that another Insectivore, Centetes ecaudatus of Madagascar, the Comoro Islands and introduced to Mauritius and Réunion, has very differing hair length and color: The Malagassy specimens mostly have a hair length on the back of about 3 cm, whereas two among several specimens we received from the Comoros, had hair longer than 6 cm and of quite variable color.

- E. Here too, individual variations can be stated, possibly age-related.
- F. Tooth size depends on its relation to the overall size of the skull. No exact indications whatever are given by CABRERA. If CABRERA took this item from Peters (1863), he seems to have overlooked Peters's statement, that the specimens investigated by him were relatively young animals, as explained above, in item C. Since, on account of paucity of available material, Peters very probably was unable to distinguish between decidous and permanent Insectivore teeth (like later on Leche, 1907), Cabrera's criterion regarding tooth size can be disregarded.
- G. We were able to find skulls of Solenodon paradoxus (AMNH, No. 28270 and MCZ, No. 35312) with no smaller diastema than in Solenodon cubanus. Admittedly, there may exist a tendency to a greater diastema in the Cuban form, but this does not warrant relegating a different genus.
- H. This is the only substantial difference between the two forms we were able to confirm.
- J. Fig. 3 is a photograph of a Cuban Solenodon with triangular P^{2*} (NMNH, No. 49508), as described by Allen and Cabrera. However, the MCZ in Harvard owns also the skull of a Cuban Solenodon (No. 46305) with a P² of triangular outline on the right side and an oval one on the left (Fig. 4). Likewise, Solenodon paradoxus (e. g. MCZ, No. 34833) sometimes shows one or both triangular second upper premolars (Fig. 5), which indicates the occuring variability which may occasionally produce anomalies like double teeth (CMNH Pittsburgh, No. 18069) (Fig. 6).
- K. The number of vertebrae varies individually in many mammals, including man. Connected with the number of the vertebrae is the number of the ribs, which varies accordingly. Therefore, it cannot serve as a generic criterion**.

Conclusion

PETERS, DOBSON, ALLEN, and CABRERA collectively had very little material at their disposal and obviously did not consider the immaturity of some of their material. The features and items named by them as differentiating criteria seem not to allow each of the two geographically separated taxa the status of its own genus. Since, furthermore, most of these differential criteria mentioned are trivial and/or questionable, the two taxa should not be separated into two different (and both monotypic)

^{*} Avoiding the much discussed problem, which premolar of the Eutheria was lost in the course of their phylogeny, it is prefered here to rely on CLEMENS (1979) and to numerate the extant premolars with P¹, P², and P³.

^{**} The same holds for the variable number of sternal elements mentioned by ALLEN (1910).



Fig. 1: Rather unused long claws of Solenodon cubanus.

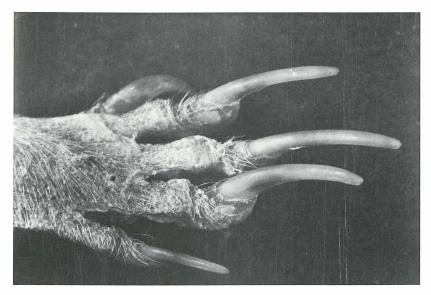


Fig. 2: Claws of Solenodon paradoxus.

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Fig. 3: S. cubanus with triangular P2.

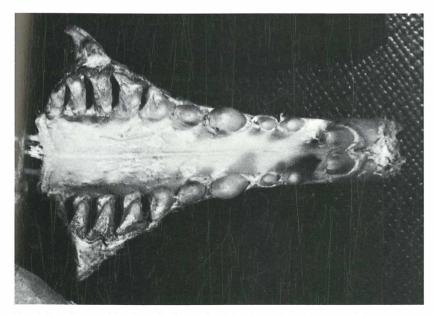


Fig. 4: S. cubanus with triangular P^2 on the right side and oval P^2 an the left.

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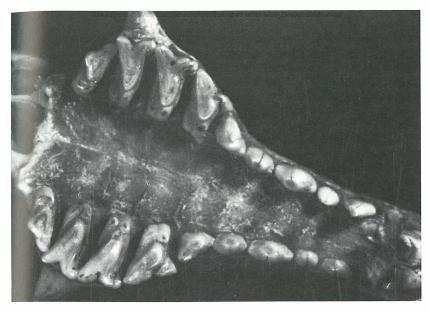


Fig. 5: S. paradoxus with one triangular and one nearly oval P2.

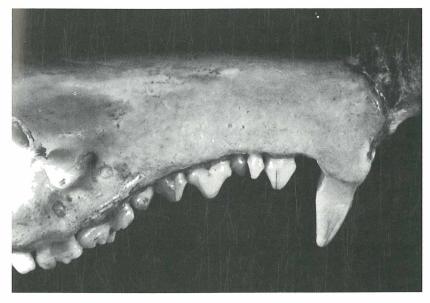


Fig. 6: S. paradoxus with double I3.

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genera. Thus, they should remain being considered as two species of but one genus. According to priority, they should retain the generic name Solenodon Brandt, 1833, and the species names Solenodon paradoxus Brandt, 1833, and Solenodon cubanus Peters, 1863. To be correct, to the last should be added in brackets (= S. paradoxus Poey, 1851, non Brandt, 1833). According to Art. 23 (i), International Zoological Nomenclatory (Kraus, 1962), Atopogale Cabrera, 1925 should dissapear into synonymy, being a junior synonym of Solenodon Brandt, 1833.

Certainly, there exist certain tendencies in some of the named features, which can be found more often or more developed in one of the two species, and which cannot be explained as influences related to habitat or climate, like fur or claw length.

We refer here e. g. to the anterior basal cusp on the upper canine in S. cubanus or to the tendency to a more distinct diastema in the same species. However, these apparently nonfunctional features seem inadequate to separate the two species by a generic barrier.

It certainly would be interesting to compare the complete ethograms and selected physiological features of the two species, heterofore improbable. An equally relevant approach could be the comparison of their vocalizations. As is known from Eurasian and African hedghogs, there exist not only similarities but also intergeneric and intrageneric variations in acoustic signals, which give the impression of the existence of different "dialects" (Poduschka, unpublished).

Of enormous importance for our theme should be the phylogeny of the Solenodontidae, as are the nature and the time of the separation of the two species, which should have caused the number of small - if even in some cases dubious - variations. This is rendered more difficult by the sober fact that according to our present knowledge the genus Solenodon exists only on the adjacent islands of Cuba and Hispaniola. Up to date neither fossil, subfossil, nor recent remains have been found on the other islands of the Greater Antillas, Jamaica and Puerto Rico. Possibly, the divergence of the two species started after the forming of the Windward Passage, separating Cuba and Hispaniola. Fossil Solenodontidae are known from both islands (PATTERSON, 1962; MORGAN et al., 1980; VARONA, 1974, 1983), but the problem is complicated by the fact that Hispaniola was divided into north and south islets at least once in the Quarternary (Pregill & Olson, 1981). These authors also report that no terrestrial vertebrate fossils are known from the West Indies before the Pleistocene. Whether the tectonic fault south of Cuba according to MÜHLBERGER and RITCHIE (1975) being the northern boundary of the Caribbean plate has something to do with their statement we dare not to decide. GASCOYNE et al. (1979) and OLSON & PREGILL (1982) suggest that eustatic fluctations in the Pleistocene could have lowered the sea level about 120 m during the Wisconsin glaciation. The thus formed landmass, now the submerged Great Bahama Bank, was then separated from the

Cuban mainland by only the 15 mls wide Old Bahama Channel. We hope indeed that the ample research started by ROSEN (1967) will soon bring reasonable and generally recognized facts. The theoretical discussion by MacFadden (1980) on the suggested relationship between early soricomorph Insectivore distribution throughout North America, Nuclear America and the Proto-Antilles (Apternodontia and possibly the Geolabidids extinct in late Oligocene) as they relate to Solenodon and Nesophontes, are beyond our evaluation. His literal remark that "Solenodon is certainly larger than most shrews and has body lengths of about 15–16 cm and weights of 40–46 g (data for S. paradoxus born in captivity, see Peña Franjul, 1977)" indicate that he never saw a living Solenodon or its remains in a collection. Solenodon is about 40 cm long (without tail) and weighs about 600–1000 g. Peña (1977) referred to newborn Solenodon.

However, this paper is not intended to explore geological or paleontological problems. The curious fact remains that no close relative of the Solenodontidae has ever been found in the Western hemisphere. Ample studies and speculations of possible relationships among or on possible remote ancestors of *Solenodon* derive from McDowell (1958), Thenius (1969, 1980), and McKenna's group, but these subjects are beyond the scope of this paper.

Summary

CABRERA (1925) gave the Cuban form of the Solenodontidae the status of an own genus, Atopogale cubana, which, however, by later authors was mostly neglected or not accepted. Therefore, CABRERA's differentiating criteria as well as those by previous authors were revised, compared, and evaluated by means of much more material (11 live specimens of S. paradoxus, skeletal material of 71 S. paradoxus and 16 S. cubanus) than CABRERA had at his disposition.

The said criteria were found not to justify the distinction into two, both monotypic genera. The generic name, therefore, should be Solenodon Brandt, 1833, the species names S. paradoxus Brandt, 1833, and (correctly:) S. cubanus Peters, 1863 (= S. paradoxus Poey, 1851, non Brandt, 1833).

Zusammenfassung

Die Taxonomie der rezenten Solenodontidae (Mammalia: Insectivora): Eine Synthese.

CABRERA (1925) gab der kubanischen Form der Gattung Solenodon den Status einer eigenen Gattung. Da diese anscheinend von den meisten Autoren übersehen oder nicht anerkannt worden war, wurden die Kriteria CABRERAS und die früherer Autoren gegenübergestellt und geprüft. Auf Grund weit zahlreicheren Materials (elf lebende

S. paradoxus, sowie Skelettmaterial von 71 S. paradoxus und 16 S. cubanus) wurden die Kriteria als nicht schwerwiegend genug anerkannt, um der kubanischen Form tatsächlich Gattungsstatus zuzuerkennen.

Demnach lautet der Gattungsname nach wie vor Solenodon BRANDT, 1833, die Artnamen jedoch Solenodon paradoxus BRANDT, 1833, und korrekterweise Solenodon cubanus Peters, 1863 (= S. paradoxus Poey, 1851, non BRANDT, 1833).

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References

- Alcober, R. C. (1971): The last Almiquis (Solenodon cubanus) in Captivity. Zool. Garten N. F., Leipzig 40, 1-3.
- Allen, G. M. (1910): Solenodon paradoxus. Mem. Mus. Comp. Zoöl. Harvard, 40, 1-54.
- (1942): Extinct and vanishing mammals of the Western Hemisphere. Amer.
 Comm. Intern. Wild Life Prot.
- ALLEN, J. A. (1908): Notes on Solenodon paradoxus Brandt. Bull. Amer. Mus. Nat. Hist., 24, 505-517.
- Angulo, J. J. (1947): Teat Location in the Cuban Solenodon. J. Mammal., 28, 298-299.

- Anonymus (1861): Remarks on Peters' notes on Solenodon in a session of the K. Academy of Sciences. Monatsber. K. Akad. Wiss. Berlin, 1861; p 169 and 551.
- BARBOUR, T. (1944): The Solenodons of Cuba. Proc. New England Zoöl. Club, 23, 1-8.
- Brandt, J. F. (1833): De Solenodonte. Nove mammalium insectivorum genere. Mém. l'Acad. Impér. Sciences St. Pétersbourg. 6ème Série, Tome II, 459-478.
- Bridges, W. (1936): The Haitian Solenodon. Bull. New York Zool. Soc., 39, 13-18.
- CABRERA, A. (1925): Genera Mammalium. Insectivora, Galeopithecia. Madrid. CAVE, A. J. F. (1968): The hyoid arch of Solenodon cubanus. J. Zool. Lond. 155,
- 451–460.
- CLEMENS, W. A. (1979): Marsupialia. In: J. A. LILLEGRAVEN, Z. KIELAN-JAWOROWSKA & W. A. CLEMENS (edts): Mesozoic Mammals. California Press, Berkeley: 192–220.
- CRANDALL, L. S. (1949): Animal Kingdom, 52 (3), 95.
- (1964): The Management of Mammals in Captivity. Chicago.
- Dobson, G. E. (1882): A Monograph of the Insectivora, systematic and anatomical.

 London.
- EISENBERG, J. F. (1981:) The Mammalian Radiations. Chicago Press.
- EISENBERG, J. F. & GONZALES, N. G. (1983): The Natural History of Solenodon cubanus. Acta Zool. Fenn (in press).
- EISENBERG, J. F. & GOULD, E. (1966): The Behavior of Solenodon paradoxus in Captivity with Comments on the Behavior of other Insectivora. Zoologica Cont. New York Zool. Soc., 51, 49-57.
- Eisentraut, M. (1976): Das Gaumenfaltenmuster der Säugetiere und seine Bedeutung für stammesgeschichtliche und taxonomische Untersuchungen. Bonner zool. Monographien, 8, Bonn. Univ. Druck.
- GASCOYNE, M., BENJAMIN, G. J., SCHWARZ, H. P., FORD, D. C. (1979): Sea-Level Lowering During the Illinoian Glaciation: Evidence from a Bahama "Blue Hole" Science, 205, 806-808.
- Gundlach, J. C. (1877): Contribución a la mamalogía cubana. G. Montiel y Cia, La Habana.
- HAFFNER, K. v. (1940): Untersuchungen über einen bisher unbekannten Acanthocephalen aus Schlitzrüsslern (Solenodon paradoxus BRANDT), Zt. wiss. Zool., 40, 277–304.
- HALL, E. R. (1981): The Mammals of North America. Academic Press, New York.
- HALL, E. R. & KELSON, K. R. (1959): The Mammals of North America. Ronald Press Comp., New York.
- HERTER, K. (1967): Die Insektenesser. In: Grzimeks Tierleben, Zürich: Kindler-Verlag. 10, 263-313.
- HONACKI, J. H., KINMAN, K. E. & KOEPPL, J. W. (1982): Mammal Species of the World. Allen Press, Inc. & Association of Systematics Collections.
- Kratochvil, J. (1976): Ein neuer Fund von Atopogale cubanus (Peters) (Insectivora, Mamm.). Zool. Listy, 25, 113-115.

- Kraus, O. (1962): Internationale Regeln für die zoologische Nomenklatur. Deutscher Text. Senckenbergische Naturforsch. Ges., Frankfurt a. M.
- LECHE, W. (1907): Zur Entwicklungsgeschichte des Zahnsystems der Säugetiere. 2. Teil: Phylogenie, 2. Heft: Die Familien der Centetidae, Solenodontidae und Chrysochloridae. Schweizerbartsche Verlagsbuchhandlung, Stuttgart.
- MAYR, E. (1975): Grundlagen der zoologischen Systematik. Parey, Hamburg und Berlin.
- McDowell, S. B. (1958): The Greater Antillean Insectivores. Bull. Amer. Mus. Nat. Hist., 115, 118-214.
- McFadden, B. J. (1980): Rafting mammals of drifting islands?: Biogeography of the Greater Antillean insectivores *Nesophontes* and *Solenodon*. J. Biogeography, 7, 11–12.
- MOHR, E. (1936-1938): Biologische Beobachtungen an Solenodon paradoxus in Gefangenschaft. I-IV. Zool. Anz. 113, 177-188; 116, 65-76; 117, 233-241; 122, 132-143.
- MORGAN, G. S., RAY, C. E. & ARREDONDO, O. (1980): A Giant Extinct Insectivore from Cuba (Mammalia: Insectivora: Solenodontidae). Proc. Biol. Soc. Wash. 93, 597-608.
- MÜHLBERGER, W. R., RITCHIE, A. W. (1975): Caribbean-Americas plate boundary in Guatemala and Southern Mexico as seen on Skylab IV orbital photography. Geology, May 1975: 232–235.
- OVIEDO y VALDES, G. F. (1535): La historia general de las Indias. Sumario de la natural y general de las Indias yslas y Tierra Firme del mar oceano, 4 + i exciij fols. Seville Juan Cromberger.
- PATTERSON, B. (1962): An extinct Solenodontid Insectivore from Hispaniola. Breviora, Mus. Comp. Zool., Nr. 165, 1-11.
- Peña Franjul, M. (1977): Habitos nutritivos del Solenodon paradoxus Brandt y el programa de reproduccion en cautivitad. Zoodom, 1, 11–25.
- Peters, W. (1863): Die Säugethier-Gattung Solenodon. Abh., Königl. Akad., Wiss. Berlin. 1-22.
- Poduschka, W. & Nopp, H. (1978): Fellfarbenänderung gefangengehaltener Mullratten, Cryptomys hottentottus (Lesson, 1826). Säugetierkundl. Mitt., 26, 275–279.
- POEY, F. (1851): Memorias sobre la historia natural de la isla de Cuba. Havana, Barcina, Vol. 1.
- Pregill, G. K. & Olson, S. L. (1981): Zoogeography of West Indian Vertebrates in Relation to Pleistocene Climatic Cycles. Ann. Rev. Ecol. Syst. 12, 75–98.
- Rosen, D. E. (1978): Vicariant Patterns and Historical Explanation in Biogeography. System. Zool., 27 (2), 159-188.
- SIMPSON, G. G. (1945): The Principles of Classification and a Classification of Mammals. Bull. Amer. Mus. Nat. Hist., 85, 1-350.
- STARCK, D. (1978): Vergleichende Anatomie der Wirbeltiere auf evolutionsbiologischer Grundlage. I. Springer-Verlag, Berlin, Heidelberg und New York.
- (1979): Vergleichende Anatomie der Wirbeltiere auf evolutionsbiologischer Grundlage, II. Springer-Verlag, Berlin, Heidelberg und New York.

- THENIUS, E. (1969): Stammesgeschichte der Säugetiere. Handb. d. Zool., 8. 47. Lief., 1-368. De Gruyter, Berlin.
- (1980): Grundzüge der Faunen- und Verbreitungsgeschichte der Säugetiere.
 Fischer, Stuttgart New York.
- TIJSKENS, J. (1967): Solenodon paradoxus Brandt. Zoo Antwerp. Soc. Roy. de Zool. d'Anvers. 142–144.
- TRUE, F. W. (1886): The Almiqui. Science, 8, No. 190, 282.
- Varona, L. S. (1974): Catálogo de los mamíferos vivientes y extinguidos de las Antillas. Inst. Zool. Acad. Cien. Cuba.
- (1977): Cuban Solenodon surveyed. Oryx, July 1977, 7.
- (1983): Biological Parameters and Zoogeography of Solenodon (Atopogale) cubanus (Mammalia: Insectivora). Bijdrag'en tot de Dierkunde, 53 (1): 93-98.
- Verrill, A. H. (1907): Notes on the Habits and External Characters of the Solenodon of San Domingo (Solenodon paradoxus). Ann. Mag. Nat. Hist., 20, 7, ser., 68-70.
- Weber, M. (1928): Die Säugetiere I/II. Jena.
- WISLOCKI, G. B. (1940): The Placentation of Solenodon paradoxus. Amer. J. Anat., 66, 497-516.